METHOD AND APPARATUS FOR HAVING VIDEO IN A TWO-WAY RADIO

The present invention relates to an apparatus and associated method to transmit and receive an audio signal and/or video signal with a two-way radio.

A two-way radio typically does not provide very much flexibility in the transmitting and receiving of data. Thus there is a need for a two-way radio to provide more flexibility in the transmitting and receiving of data.

The present invention provides a device, comprising:

a two-way radio comprising a transmitter system and a receiver system, wherein the transmitter system is adapted to transmit a first digitized video signal, wherein the transmitter system is adapted to transmit a first digitized audio signal, wherein the receiver system is adapted to receive a second digitized video signal, and wherein the receiver system is adapted to receive a second digitized audio signal.

The present invention provides a method, comprising:

providing a two-way radio comprising a transmitter system, wherein the transmitter system comprises a video input device, an audio input device, an analog to digital A/D converter block, an encoder block, a modulator, and a transmitter;

receiving and digitizing, by the A/D converter block, a video signal from the video input device and an audio signal from the audio input device;

digitally compressing, by the encoder block, the digitized audio signal, the digitized video signal, or both the digitized audio signal and the digitized video signal;

modulating, by the modulator, the digitally compressed audio signal, the digitally compressed video signal, or both the digitally compressed audio signal and the digitally compressed video signal so as to generate a digitally compressed modulate signal; and

transmitting, by the transmitter, the digitally compressed modulated signal.

The present invention provides more flexibility for a two-way radio to transmit and receive data by having the two way radio transmit and receive both video data and audio data.

FIG. 1 depicts a block diagram view of a two-way radio in communication with a second two-way radio, in accordance with embodiments of the present invention.

FIG. 2 illustrates a detailed block diagram view of a transmitter system in, in accordance with embodiments of the present invention.

FIG. 3 illustrates a detailed block diagram view of a receiver system, in accordance with embodiments of the present invention.

FIG. 4 illustrates a flowchart depicting an algorithm showing a process of the transmitter system in FIG. 2, in accordance with embodiments of the present invention.

FIG. 5 illustrates a flowchart depicting an algorithm showing a process of the receiver system in FIG. 3, in accordance with embodiments of the present invention.

FIG. 1 depicts a block diagram view of a two-way radio 55 comprising a transmitter system 1 and a receiver system 24 in communication with a second two-way radio 58 that is equivalent to the two-way radio 55, in accordance with embodiments of the present invention.

The second two-way radio 58 comprises a transmitter system 101 and a receiver system 124.

The transmitter system 1 (see FIG. 2 for detailed block diagram) is adapted to transmit an audio signal, a video signal or both the audio signal and the video signal together to the second two-way radio 58. The receiver system 24 (see FIG. 3 for detailed block diagram) is adapted to receive a second audio signal, a second video signal or both the second audio signal and the second video signal together from the second two radio 58. The two-way radios 55 and 58 may, inter alia, comprise walkie talkies with video capabilities.

FIG. 2 illustrates a detailed block diagram view of the transmitter system 1 in FIG. 1, in accordance with embodiments of the present invention. The transmitter system 1 comprises a video input device 2, an audio input device 3, an analog to digital A/D converter block 22, a command input device 8, an encoder block 9, a modulator 15, a transmitter 16, and an antenna 20. The video input device 2 may be any video input device known to a person of ordinary skill in the art such as, inter alia, a video camera. The video input device 2 is used to accept video data such as, inter alia, a video of a user. The audio input device 3 may be any audio input device known to a person of ordinary skill in the art such as, inter alia, a microphone. The audio input device 3 is used to accept audio data such as, inter alia, a voice of the user. The video input device 2 transmits the video data to an analog to digital (A/D) convertor block 22 comprising a video A/D convertor 4 to convert the video data to a digital video signal. The audio input device 3 transmits the audio data to the analog to digital A/D convertor block 22 comprising an audio A/D convertor 5 to convert the audio data to a digital audio signal. The encoder block 9

comprises a video encoder 10, an audio encoder 12, a switching means 11, and a multiplexer 14. The encoder block 9 may be a low bit rate encoder block. The switching means 11 is used to transmit the digitized audio signal from the audio A/D converter 5 to the audio encoder 12, the digitized video signal from the video A/D converter 4 to the video encoder 10, or both the digitized audio signal to the audio encoder 12 and the digitized video signal to the video encoder 10. The command input device 8 allows the user enter commands for control of the encoder block 9 such as, inter alia, signal(s) for encoding, bit rate, video resolution, etc. The command input device 8 may include any input device known to a person of ordinary skill in the art such as , inter alia, a keypad, a keyboard, etc. The encoder block 9 may comprise a hardware encoding block or a software encoder block. The hardware encoder block comprises all components within the encoder block 9 in dedicated hardware including: hardware encoders (video encoder 10, an audio encoder 12), a hardware switching means (switching means 11), and a hardware multiplexer (e.g., Integrated circuit (IC)). The hardware encoders may be any hardware encoders known to a person of ordinary skill in the art such as, inter alia, application specific integrated circuit (ASIC), etc. The hardware switching means may include any hardware switching means known to a person of ordinary skill in the art such as , inter alia, a hardware switch, a mechanical relay, a solid state relay, etc. The hardware switching means will physically connect or disconnect any digitized audio signals, any digitized video signals, or any combination thereof to/from their respective hardware encoders (audio encoder 5, video encoder 4) depending upon user specification resulting in a compression of only specified signals. Only the compressed signals will be transmitted to the second two-way radio 58 of FIG. 1. Alternatively, the software encoder block 9 comprises all components within the encoder block 9 as software blocks including: software encoders (video encoder 10, an audio encoder 12), a software switching means (switching means 11), and a software multiplexer (e.g., multiplexing algorithm). The software encoder block 9 enables a user to program features of encoding such as, inter alia, video resolution, bit rate, etc. Video resolution may comprise any format known to a person of ordinary skill in the art such as, inter alia, common interface format (CIF), quarter CIF, etc. The software encoders may be any software encoders known to a person of ordinary skill in the art such as, inter alia, a media processor (e.g., Nexperia® from Philips), a digital signal processor (DSP), etc. The software switching means will

enable/disable audio or video encoding (in a software encoding application) depending upon user specification resulting in a compression of only specified signals. The software switching may be implemented using an algorithm. Hardware encoding or software encoding may use any compression standard known to a person of ordinary skill in the art such as, inter alia, Moving Pictures Experts Group- 4 (MPEG- 4) and H.263. Any signals that have been compressed are multiplexed by the multiplexer 14. The multiplexed signal is modulated by the modulator 15 and transmitted through the antenna 20 by the transmitter 16. The modulated signal may be transmitted over any service known to a person of ordinary skill in the art such as, inter alia, Family radio service (FRS), General Mobile Radio Service (GMRS), etc. The modulated signal may be transmitted in a bandwidth that is in, inter alia, a range of about 10 Kilobits/second (kbps) to about 20 kbps when transmitting the modulated signal over FRS and GMRS frequency bands. Higher bit rates may be achieved when the modulated signal is transmitted over a larger frequency band. The modulated signal is demodulated by the demodulator 32 and transmitted to the decoder block 34. The two way radio may comprise the capability to transmit the modulated signal over FRS and/or GMRS service. The frequency range FRS is shown by Table 1 below:

Table 1

Channel	Frequency (MHZ)
1	462.5625
2	462.5875
3	462.6125
4	462.6375
5	462.6625
6	462.6875
7	462.7125
8	467.5625
9	467.5875
10	467.6125
11	467.6375
12	467.6625
13	467.6875
14	467.7125

Table 1 shows a 25 KHZ separation between successive channels in each band (e.g., channels 1-7 in the 462 MHZ range, channels 8-14 in the 467 MHZ range). The modulated signal may be transmitted within this 25 KHZ separation. Alternatively, the modulated signal may be transmitted over multiple channels so that a higher bit rate stream is achieved. The bit rate stream for multiple channels may be in a range of, inter alia, about 5 Kbps to about 64 Kbps.

The frequency range for GMRS is shown by Table 2 below:

Table 2

Channels	Frequencies
1	462.550
2	462.575
3	462.600
4	462.625
5	462.650
6	462.675
7	462.700
8	462.725
9	467.550
10	467.575
11	467.600
12	467.625
13	467.650
14	467.675
15	467.700
16	467.725

Chart 2 shows a 25 KHZ separation between successive channels in each band (e.g., channels 1-8 in the 462 MHZ range, channels 9-16 in the 467 MHZ range). The modulated signal may be transmitted within this 25 KHZ separation. Alternatively, the modulated signal may be transmitted over multiple channels so that a higher bit rate stream is achieved. The bit rate stream for multiple channels may be in a range of, inter alia, about 5 (Kbps) to about 64 Kbps.

FIG. 3 illustrates a detailed block diagram view of the receiver system 24 in FIG. 1, in accordance with embodiments of the present invention. The receiver system 24 comprises the antenna 20 of FIG. 2, a receiver 29, a demodulator 32, an decoder block 34, the command input device 8 of FIG. 2, an digital to analog (D/A) converter block 50, a video output device 44, and an audio output device 46. A modulated signal is received by

the receiver 29 through the antenna 20 from another device such as the second two radio 58 of FIG. 1. The modulated signal may be received over any service known to a person of ordinary skill in the art such as, inter alia, Family radio service (FRS), General Mobile Radio Service (GMRS), etc. The modulated signal may be received in a bandwidth that is in a range of, inter alia, about 10 Kilobits/second (kbps) to about 20 Kbps when receiving the modulated signal over FRS and GMRS frequency bands. Higher bit rates may be achieved when the modulated signal is received over a larger frequency band. The modulated signal is demodulated by the demodulator 32 and transmitted to the decoder block 34. The two way radio may comprise the capability to receive the modulated signal over FRS and/or GMRS service. The frequency range for FRS is shown by Chart 1 in the FIG. 2 description and the frequency range for GMRS is shown by Chart 2 in the FIG. 2 description. Chart 1 (FRS) shows that there is a 25 KHZ separation between successive channels in each band (e.g., channels 1-7 in the 462 MHZ range, channels 8-14 in the 467 MHZ range). Additionally, chart 2 (GMRS) shows that there is a 25 KHZ separation between successive channels in each band (e.g., channels 1-8 in the 462 MHZ range, channels 9-16 in the 467 MHZ range). The modulated signal may be received within this 25 KHZ separation. Alternatively, the modulated signal may be received over multiple channels so that a higher bit rate stream is achieved. The bit rate stream for multiple channels may be in a range of, inter alia, about 5 Kbps to about 64 Kbps. The decoder block 34 comprises a video decoder 35, an audio decoder 38, a second switching means 37, and a demultiplexer 36. The decoder block 34 may be a low bit rate decoder block. The demultiplexer 36 receives the demodulated signal and demultiplexes the signal back into a compressed video signal and a compressed audio signal. The second switching means 37 is used to transmit the compressed audio signal to the audio decoder 38, the compressed video signal to the video decoder 35, or both the compressed audio signal to the audio decoder 38 and the compressed video signal to the video decoder 35. The command input device 8 allows the user enter commands for control of the decoder block 34 such as, inter alia, signal(s) for decoding, video resolution, etc. The command input device 8 may include any input device known to a person of ordinary skill in the art such as , inter alia, a keypad, a keyboard, etc. The decoder block 34 may comprise a hardware decoder block or a software decoder block. The hardware decoder block comprises all components within the decoder block 34 in dedicated hardware including: hardware decoders (video decoder

35, audio decoder 38), a second hardware switching means (switching means 37), and a hardware multiplexer (e.g., Integrated circuit (IC)). The hardware decoders may be any hardware decoders known to a person of ordinary skill in the art such as, inter alia, application specific integrated circuit (ASIC), etc. The second hardware switching means may include any hardware switching means known to a person of ordinary skill in the art such as , inter alia, a hardware switch, a mechanical relay, a solid state relay, etc. The hardware switching means will physically connect or disconnect any compressed audio signals, any compressed video signals, or any combination thereof to/from their respective hardware decoders (audio decoder 38, video decoder 35) depending upon user specification resulting in a decompression of only specified signals. Only the decompressed signals will be transmitted to the D/A converter block 50 for processing. Alternatively, the software decoder block comprises all components within the decoder block 34 as software blocks including: software decoders (video decoder 34, audio decoder 38), a second software switching means (switching means 37), and a software multiplexer (e.g., multiplexing alogorithm). The software decoder block enables a user to program features of decoding such as, inter alia, video resolution, bit rate, etc. Video resolution may comprise any format known to a person of ordinary skill in the art such as, inter alia, common interface format (CIF), (QCIF), etc. The software decoders may be any software decoders known to a person of ordinary skill in the art such as, inter alia, a media processor (e.g., Nexperia® from Philips), a digital signal processor (DSP), etc. The second software switching means will enable/disable audio or video decoding (in a software decoding application) depending upon user specification resulting in a decompression of only specified signals. The software switching may be implemented using an algorithm such as the algorithm of FIG. 5. Hardware decoding or software decoding may use any decompression standard known to a person of ordinary skill in the art such as, inter alia, Moving Pictures Experts Group- 4 (MPEG- 4) and H.263. Any signals that have been decompressed are converted to analog signals by the D/A converter block 50 comprising a video D/A converter 40 and an audio D/A converter 42. An analog audio signal is transmitted to the audio output device 46 and an analog video signal is transmitted to the video output device 44. The video output device 44 may be any video output device known to a person of ordinary skill in the art such as, inter alia, a monitor. The monitor may be any monitor known to a person of ordinary skill in the art such as, inter alia, a liquid crystal display (LCD) monitor, a

cathode-ray tube (CRT) monitor, a color monitor, a monochrome monitor, etc. The video output device 44 is used to accept video data such as, inter alia, video of a user. The audio output device 46 may be any audio output device known to a person of ordinary skill in the art such as, inter alia, an amplifier and a speaker, etc. The audio output device 46 is used to accept audio data such as, inter alia, a voice of the user.

FIG. 4 illustrates a flowchart depicting an algorithm showing a process of the transmitter system 1 in FIG. 2, in accordance with embodiments of the present invention. In step 60 a user inputs an audio signal (e.g., voice the user) and a video signal (e.g., video of the user). The audio signal and video signal are digitized in step 62. The user inputs a command through the command input device 8 (see FIG. 2) to compress the digitized audio signal, the digitized video signal or both the digitized audio signal and the digitized video signal in step 63. If the user chooses to compress just the digitized audio signal in step 63, the audio signal is compressed in step 64, multiplexed in step 67, modulated in step 69, and transmitted in step 70. If the user chooses to compress just the digitized video signal in step 63, the video signal is compressed in step 66, multiplexed in step 79, modulated in step 80, and transmitted in step 82. If the user chooses to compress both the digitized video signal the digitized video signal in step 63, the audio signal and the video signal are compressed in step 65, multiplexed in step 73, modulated in step 75, and transmitted in step 77.

FIG. 5 illustrates a flowchart depicting an algorithm showing a process of the receiver system 24 in FIG. 3, in accordance with embodiments of the present invention. In step 83 a user receives a compressed audio signal (e.g., voice the user) and a compressed video signal (e.g., video of the user) from the second two-way radio of FIG.1. The compressed audio signal and compressed video signal are demodulated in step 84 and demultiplexed in step 85. The user inputs a command through the command input device 8 see (FIG. 3) to receive the compressed audio signal, the compressed video signal or both the compressed audio signal and the compressed video signal in step 86. If the user chooses to receive just the compressed audio signal in step 86, the audio signal is decompressed in step 88, converted to an analog signal in step 89, and outputted to the audio output device 46 (FIG. 3) in step 90. If the user chooses to receive just the compressed video signal in step 86, the video signal is decompressed in step 96, converted to an analog signal in step 97, and outputted to the video output device 44 (FIG. 3) in step

98. If the user chooses to receive both the compressed video signal and the compressed audio in step 86, the video signal and audio signal are decompressed in step 92, converted to an analog signals in step 93, and outputted to the video output device 44 (FIG. 3) and audio output device 46 in step 94.

While embodiments of the present invention have been described herein for purposes of illustration, many modifications and changes will become apparent to those skilled in the art. Accordingly, the appended claims are intended to encompass all such modifications and changes as fall within the true spirit and scope of this invention.